The Effects of Health Facility Access and Quality on Family Planning Decisions in Urban Senegal

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Abstract: Research in developing countries is rarely focused on examining how supply side factors affect family planning decisions due to a lack of facility-level data. When these data exist, analyses tend to focus on rural environments. In this paper we study the effects that health facility access and quality have on both contraceptive use and desired number of children for women in urban Senegal. Unlike related studies focusing on rural environments, we find no evidence that greater access to health facilities and pharmacies increases contraceptive use among urban women. However, we do find that contraceptive use among urban women is higher with greater facility quality. For example, we find that increasing the proportion of pharmacies employing multiple pharmacists from 0% to 50% would increase contraceptive use by 6.0 percentage points and increasing the proportion of facilities with family planning guidelines/protocols from 50% to 100% would increase use by 2.1 percentage points.

Keywords: Health facility quality, Family planning decisions, Urban health programs, Endogenous program placement, Discrete factor random effects

JEL Codes: J13, I14

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1. Introduction

Family planning (FP) leads to significant health benefits for women and children (Cleland et al., 2012; Ezeh et al., 2012; Tsui, McDonald-Mosley, Burke, 2010) and additional economic and educational benefits for families and communities (Canning and Shultz, 2012). However, sub-Saharan Africa and the West African region in particular lag in the uptake of FP programs (Cleland et al., 2011; Khan et al., 2007). While there is an abundance of research on FP decisions in sub-Saharan Africa (Cleland et al., 2011; Wang et al. 2012), often the effect of supply side factors are not studied due to lack of facility-level data, and if facility-level data is available, analyses are focused frequently on rural environments (Chen and Guilkey, 2003; Feyiestan and Ainsworth, 1996; Arends-Kunning and Kessy, 2007; Angeles, Guilkey, Mroz, 2005). This focus on rural environments is due in part to the fact that measurement of supply side factors is less challenging in rural areas than in densely populated urban areas. In this research, we study the effects of health facility access and quality on contraceptive use and desired number of children in urban Senegal.

Senegal is of interest because its population nearly doubled from 1988 to 2010 when it increased from 6.9 million to an estimated 13 million people. The total fertility rate nationally is 5.0; in urban areas it is 3.9 (ANSD, ICF International, 2012). The region of Dakar represents 0.3% of the surface area of the country but about 23% of the total population and 75% of the urban population (ANSD, ICF International, 2012). It also has the highest concentration of public and private health care facilities; despite this, less than 18% of the female population 15-49 currently uses contraceptives.

We address a number of empirical and methodological challenges. First, women living in urban environments may seek services from any number of local health facilities; therefore, it is not clear how the supply of FP services should be measured. In rural environments there is often only one health facility within a 5 or 10-kilometer radius of a woman's home, which simplifies both the collection of facility-level data and measurement of FP services (Hong, Montana, Mishra, 2006). Urban environments contain many facilities from which women can obtain services. Therefore, the measurement of the supply side environment requires data from a much larger number of facilities. Moreover, how one should measure access to and quality of these facilities is less obvious. To address this issue, we utilize survey data that includes a complete census of facilities offering reproductive health services in our study area. We then examine empirically the best way to define a woman's service environment.

Though related papers often focus on contraceptive use, we also study the impact that supply side factors have on the "ideal" number of children reported by women. In addition to being an interesting policy variable (Cohen, 2000; Castle, 2003), we include it in an effort to disentangle the channels through which supply side factors influence contraceptive use. Our model allows supply side factors to impact the ideal number of children and contraceptive use, while controlling for the effect that the ideal number of children has on contraceptive use. This introduces two methodological challenges. First, a woman's fertility desires are endogenous to her decision to use FP methods. Second, more than one-fifth of our sample gives a non-numeric response to questions on ideal family size, the most common of which is "up to God". We address these issues by jointly modelling the numerical ideal number of children response as well as selection into a numerical response.

Our results show that access by itself does not impact FP decisions for these urban women, however, several measures of health facility quality are important factors. The paper concludes with a series of specification tests that both support our empirical strategy and provide insight for future empirical research on fertility and FP in developing countries.

2. Background

Studies of the determinants of FP use in sub-Saharan Africa have demonstrated a number of demographic, partner-related, and community-level factors associated with use of FP. Many studies use national-level data (Ainsworth et al., 1996, Elfstrom and Stephenson, 2012; Stephenson et al., 2012; Ali et al., 2012; Ortayli and Malarcher, 2010; Montgomery and Hewett, 2005) and only a small number examine the determinants of FP use in urban settings (Onwuzurike et al., 2001; Ezeh et al., 2010; Zulu et al., 2002; Khan et al. 2007). Even fewer examine the role of FP access and quality of services. For example, using individual-level data from the 1990 Nigeria Demographic and Health Survey (DHS) and health facility-level data from a service availability assessment, Feyisetan and Ainsworth (1996) demonstrated that low availability of health and FP services is associated with lower contraceptive use. Chen and Guilkey (2003) produced similar findings in Tanzania; however, these studies contained few or no urban women. Using Malawi DHS data and a community survey on FP availability at health facilities, Cohen (2000) found that proximity to a health facility was important for rural women but not for urban. Moreover, he found that the quality of services had no effect on the decisions of either group of women. Using data from Peru, Mensch, Arends-Kuenning, and Jain (1996) find a significant association between quality of services and contraceptive use, but not availability of services. Finally, Arends-Kuenning and Kessy (2007) used the 1996 DHS and Tanzania Service Availability Survey to examine the association between quality of care and FP use. Assuming women visit the closest facility of each type (i.e., hospital, health center, or dispensary) to their home, their approach demonstrated that information given to clients (rural only) and technical competence (rural and urban) were associated with contraceptive use.

In addition to studying women living in urban Senegal, our research is unique in its use of reported ideal family size. Previous research on the association of ideal family size and contraceptive use has struggled with the coding and analysis of ideal family size in contexts like Senegal with large numbers of non-numeric responses (answers such as “up to God” or “don’t know”). In some cases, the non-numeric option is dropped from the analysis, which leads to selection bias as women who give non-numeric responses are different than women who give numeric responses (Olaleye, 1993; Saila-Ngita et al., 2003). Another strategy is to code non-numeric responses at the highest ideal family size category (Riley et al., 1993). This can bias the results by over-emphasizing women who want many children. A third approach is to recode non-numeric responses to the sample mean (Upadhyay and Karasek, 2012). This approach assumes that the unobserved characteristics of non-numeric responders are similar to those of numeric responders, which is unlikely (Olaleye, 1993) and Saila-Ngita et al., 2003). The fourth approach, which is adopted in this research, is to keep non-numeric responders in the analysis as a dummy category so that they can be compared to the responders in the other numeric categories. This imposes fewer assumptions than alternative methods, but requires the “up to God” response to be modeled.

3. Data Description

3.1 Survey Details

Data come from baseline household and facility data collected in 2011 by the Measurement, Learning & Evaluation (MLE) Project in Senegal. Data were collected from six urban sites: Dakar, Guédiawaye, Pikine, Mbao, Mbour, and Kaolack. A multi-stage sampling design was used to select a representative sample of women ages 15-49. In total, 9,614 women (88.9% response rate) responded to survey questions covering health, family, and reproductive topics. Facility data were also collected from the six sites. The goal was to undertake a census of facilities that offer FP based on a master list of health facilities and pharmacies.[1] Data were collected from 205 (of 269) health facilities and 518 (of 576) pharmacies. At each health facility, a facility audit and provider interviews were undertaken. An audit was undertaken at each pharmacy.

Further details on the multi-stage sampling design and missing facilities is provided in the web appendix, Section A.

3.2 Variables

Analysis focuses on two dependent variables: ideal number of children and usage of any FP method. The former is determined by a woman's response to the survey question "If you could have exactly the number of children you wanted to have in your whole life, how many would that be?"[2] Table 1 reveals that 18.3% of the sample responds that the ideal number is "up to God" and 3.3% either do not answer or provide some other non-numeric response. For those providing a numeric response, the mean and median ideal number of children are 4.74 and 4, respectively.[3] A woman is also asked if she is currently using any FP method(s) and, if so, which type(s). Table 1 reports the proportion of women reporting no method, modern method (i.e., implant, IUCD, injection, pill, morning after pill, condom, spermicide, and/or sterilization), and traditional method (i.e., calendar method, withdrawal,

[1] Private doctors were not included in the study sample as the focus was on access to health facilities. We do not expect this exclusion to bias our results, as less than 2% of women in our data report receiving contraceptives from a private doctor, nurse, midwife, healer, or non-medical shop.

[2] Ashraf, Field, and Lee (2012) highlight the importance of husband's preferences in FP decisions. In our data, we observe a husband's preference for additional children, but these preferences are reported by the wife. As such, we use the wife's preferred number of children only in our empirical analysis. Empirically, we find a high degree of correlation between the preferences of the wife and the wife's report of her husband's preferences.

[3] Women also report their actual number of children, of which the sample mean is 1.96.

and/or Lactational Amenorrhea). Few women report using traditional methods (1.5%); thus, estimation focuses on use of *any* FP method (16.6%).[4]

[Table 1]

In order to determine the best way to define a woman's service environment we estimated our model using a 0.5, 1.5, and 2 kilometer radius around the respondent's Primary Sampling Unit (PSU) using GPS coordinates to calculate the distances. The one-kilometer radius specification produced the strongest facility effects, as well as the largest likelihood function value. The results from each of these alternative specifications are available upon request. Table 2 reports the mean and standard deviation of these variables at the PSU and individual level using the 1 kilometer distance.[5] Several variables require explanation. A high volume facility was defined by the program as a facility that covers a catchment area with a large population, has a large number of daily clients, provides a full range of FP methods, and employs trained personnel for FP and reproductive health services (MLE, ISSU, 2012b). The facility audit allows health facilities to report the use of up to eight Information, Education, and Communication (IEC) FP tools (posters, brochures, demonstration models, etc.), which are visually verified by the survey administrator. Using information in the provider survey, we identify facilities that have "standards or protocols for FP services", as well as facilities that regularly provide FP information during a non-FP consultation. For each of these variables, we calculate the percent of providers responding

[4] Of the 1569 women using FP methods, 210 (13.7%) use a long-term modern method (e.g., male or female sterilization, an implant, or IUD), 995 (65.1%) use a short-term anticipatory modern method (e.g., pill or injection), 189 (12.4%) use a short-term non-anticipatory modern method (e.g., male or female condom, spermicide, or morning after pill), and 135 (8.8%) use a traditional method.

[5] There are 12 PSUs that have no health facility within one-kilometer of the PSU centroid (but do have at least 1 pharmacy), six PSUs that have no pharmacy within one-kilometer of the PSU centroid (but do have at least one health facility), and three PSUs that have no health facilities or pharmacies.

"yes" within each facility, and then aggregate up to the PSU level by averaging across all facilities within the one-kilometer buffer. During the audit, the provider was asked if there was a social franchise type program attached to the facility; these programs generally offer methods at a discounted price but are not very common due to the fact that most methods are offered in the public sector at low or no cost. The last variable indicates that all health facilities and pharmacies within the PSU failed to participate in the survey.[6]

[Table 2]

Table 2 reveals that the average health facility and pharmacy are similar in the number of FP methods offered and are equally likely to have a social program. The average health facility also reports significant efforts to promote FP practices, as 86% have a FP protocol, 74% provide FP information during non-FP consultations, 80% have IEC outreach programs, and 87% host health talks for the community.

Table 3 describes individual-level variables used in the analysis. We generate measures of both household income and wealth. We measure income by aggregating and transforming household consumption information into daily individual (2005) World Bank International Purchasing Power Parity Dollars. We calculate wealth from household asset data using a Demographic and Health Survey (DHS) style principle component analysis (Gwatkin et al. 2000). Table 3 contains descriptive statistics of the income measure only, as those of the wealth measure are not easily interpreted; the average individual lives on $3.81 a day. In estimation, we find that the income measure has no predictive power, so the results presented below control for wealth quintile only. There are six primary ethnic groups in

[6] There are 32 health facilities and 37 pharmacies that did not participate in the survey. To account for these facilities and pharmacies, the number of public facilities, private facilities, and pharmacies is calculated including these non-responding facilities. All other variables are calculated only using facilities participating in the survey. There are six PSUs for which only non-participating facilities are observed.

Senegal (i.e., Wolof, Poular, Serer, Diola, Mandingue, and Soninke), though the three largest (Wolof, Poular, and Serer) make up 81% of the sample. We classify a woman as working if she reports "performing some job for which she is paid in cash or kind" in the last seven days. We classify both married and cohabitating women as "married", though only 23 of the 9614 women interviewed report cohabitation.

[Table 3]

3.3 Geographic Variation in Contraceptive Use

Figure 1 is a map of the four districts of the Dakar region of Senegal that are included in our sample (Dakar, Guédiawaye, Pikine, and Mbao). The map shows both the location of all health facilities that provide FP care and an interpolated surface representing the proportion of women living in an area that uses FP methods. This figure motivates our empirical analysis in two ways: First, the map shows that areas where FP is most popular also tend to be densely populated with health facilities and pharmacies while areas void of facilities display lower FP use. This suggests that, even in urban environments, access may still play an important role. Second, some of the areas where FP use is lowest are also densely populated with facilities. This finding suggests that quality of facilities might play an important role. Alternatively, this finding could suggest that there are simply geographic differences in FP practices that are unrelated to health facility access or quality, which motivates the use of district level fixed effects.

[Figure 1]

4. Models

We jointly estimate a set of three equations of the following form:

$$\ln\left[\frac{P(G_{ij}=1)}{P(G_{ij}=0)}\right] = X_{ij}^{G}\beta_G + H_j^{G}\lambda_G + \alpha_j^{G} + \epsilon_{ij}^{G} \quad (1)$$

where the dependent variable is the log odds that woman i ($i = 1, 2, \dots, N$) from community j ($j = 1, 2, \dots, M$) responded that she would "leave it up to God" (about 20% of the sample) when asked her ideal family size. The X represents individual-level variables such as age and education that may affect the outcome. The H variables describe health facilities and pharmacies within one-kilometer of where the respondent lives. The α and ϵ represent unobserved heterogeneity at the community and individual levels, respectively.

The second equation models self-reported ideal number of children for women that provide a numeric response:

$$C_{ij} = X_{ij}^{C}\beta_C + H_j^{C}\lambda_C + \alpha_j^{C} + \epsilon_{ij}^{C} \quad (2)$$

Independent variables in this equation are identical to those in equation (1). The final equation models contraceptive use:

$$\ln\left[\frac{P(F_{ij}=1)}{P(F_{ij}=0)}\right] = C_{ij}^{F}\gamma_F + G_{ij}^{F}\delta_F + X_{ij}^{F}\beta_F + H_j^{F}\lambda_F + \alpha_j^{F} + \epsilon_{ij}^{F} \quad (3)$$

where the dependent variable is the log odds that woman i from community j uses any FP method. Note that a woman's ideal number of children or "up to God" response is allowed to affect this outcome through C and G, respectively.

Estimation is complicated by several factors. First, several studies provide strong evidence that health programs and facilities are often targeted to high need communities (e.g., Rosenzweig and Wolpin 1986; Pitt, Rosenzweig and Gibbons 1993; Gertler and Molyneaux 1994; Angeles, Guilkey and Mroz 1998). The statistical implication of this fact is that the health facility variables, H, may be correlated with unobservable fixed characteristics of the communities, α. As a result, we include community-level dummy variables representing the 41 communities from which PSU are selected. These community-level fixed effects provide a non-parametric solution to the program-targeting problem.

To control for the endogeneity of ideal family size and the "up to God" response, we allow the ϵ's in the equations above to be correlated and estimate the system of equations by full information, maximum likelihood. All parameters are technically identified by the non-linearity of the model; however, we exclude several independent variables from the FP equation. Specifically, we exclude: whether the household employs outside help, has indoor plumbing for drinking water, has indoor toilet plumbing, the number of bedrooms in the woman's home and the number of health facilities within one-kilometer that offer delivery services. In Section 5.2 we test the validity of these exclusion restrictions.

We do not make specific distributional assumptions about ϵ but rather use a Heckman and Singer (1984) type discrete factor approach where the joint distribution of $(\epsilon^G, \epsilon^C, \epsilon^F)$ is estimated along with the other parameters of the model. Each error component, ϵ, is constructed as:

$$\epsilon_{ij} = \mu_i + \eta_{ij} \tag{4}$$

where μ captures common unobserved heterogeneity across the three equations and η is the remaining independent, identically distributed (i.i.d) error term. The distribution of μ is approximated by a discrete function such that, after selecting the number of points of support (discussed in Section 5), the location and probability of support points is estimated. We assume that η follows a logistic cumulative distribution in the up to God and FP equations and a normal distribution in the ideal number of children equation.

This method allows for very general patterns of error correlations across equations. In a set of Monte Carlo experiments, Mroz (1999) found that the discrete factor random effects (DFRE) method worked almost as well as methods that assumed multivariate normally distributed errors when the true data generating process was normal and substantially better than methods that assumed normality when the true distribution was not normal. Furthermore, it also tends to do better than parametric maximum likelihood when there are weak instruments (Mroz, 1999; Guilkey and Lance, 2013). Another possible method of estimation that does not require normality assumptions is instrumental variables. Unfortunately, standard instrumental variables methods would not control for sample selectivity in our model.

5. Results

In our preferred specification, we estimate the up to God, ideal number of children, and contraceptive use equations jointly. We follow Mroz's (1999) upward testing approach; adding points of support to the heterogeneity distribution until the likelihood function improvement from an additional point is no longer significant (according to a likelihood ratio test). We find three points of support to be sufficient. The mass points for the heterogeneity distribution are presented in Table 4. A Wald test of the null hypothesis that the heterogeneity parameters are jointly equal to zero is rejected at a 1% level of significance. This suggests that the up to God and ideal number of children responses are endogenous to the contraceptive use decision; thus we focus on results for the random effects model throughout. Results for the uncorrelated model are presented for comparison.[7]

[7] We have also conducted our analysis using an indicator of "additional child wanted" in place of "ideal number of children." The main findings from that analysis are consistent with the results presented in this paper and are available upon request.

5.1 Main Estimation Results

Parameter estimates are presented in Tables 5 – 7. Coefficients on the individual-level independent variables are generally of the hypothesized sign and significance in each of the three equations. For example, we find that the likelihood of using FP increases with age. We also find that more education leads to significantly higher FP usage, lower ideal number of children, and lower likelihood of responding "up to God." Muslims are significantly less likely to use FP methods, idealize more children, and are more likely to respond "up to God." Married women are much more likely to use FP methods than unmarried women, as unmarried sex is uncommon in Senegal.[8] Furthermore, the likelihood of FP usage is significantly higher for women with educated husbands, while ideal number of children is lower. In general, married women are less likely to respond "up to God" to the ideal number of children question, though the likelihood of this response is higher for women in polygynous marriages, for women with older husbands or husbands with unknown ages, and for women with uneducated husbands.

[Tables 5, 6, 7]

There is no clear hypothesis on the effect that wealth should have on either outcome. Those with greater wealth are better equipped for costs associated with larger families, though these individual most likely face a higher opportunity cost in raising children. Our results suggest that families in higher wealth quintiles desire fewer children, which is consistent with the opportunity cost story. However, the results also suggest that those in the highest wealth quintiles are less likely to use FP methods than those in the first quintile, which is consistent with the affordability story.

[8] 96% of the unmarried women report that they have not had sex in the last three months.

Of key interest in this research is the effect that local health facility characteristics have on FP use. Results suggest that measures of health facility access within one-kilometer of a woman's home have little effect. As shown in Table 5, neither the number of public facilities, private facilities, nor pharmacies has any significant effect on the likelihood that a woman uses FP. This finding is not entirely surprising given the urban setting of our data. In our sample, 98.75% of women have at least one health facility or pharmacy within a kilometer of their home. The average health facility/pharmacy carries 4.4 FP methods, has few stock outages, and prices for contraceptives are very low; therefore, the marginal increase in access to contraceptives provided by one more facility is minimal. The quality of facilities near a woman's home has a more significant impact on her FP decisions. Contraceptive use significantly increases with the probability that pharmacies within one-kilometer of a woman's home have multiple pharmacists, and decreases with the probability that these pharmacies allow non-pharmacist staff to advise on FP issues. We also find that FP protocols in health facilities significantly increase the likelihood that women use FP. Having a health social worker within one-kilometer does not significantly alter the likelihood that a woman uses FP, but it does decrease her ideal number of children, as does the average number of FP IEC materials at the facility.

The coefficients on the up to God and ideal number of children variables have the expected sign and significance. Women who idealize a greater number of children are less likely to use FP than those wanting fewer children. This negative relationship is intensified for married women, who have greater resources to both meet and to support their desire for additional children. FP use is also lower for women responding that they wish to leave their number of children "up to God" than women wanting few children. Again, this negative relationship is intensified for married women. According to these estimates, a married woman responding “up to God” to the ideal children question uses FP methods with equal probability to an identical married woman desiring 9.6 children.

5.2 Model Specification Tests

We conducted a number of specification tests on our model to address the concerns laid out in Section 4. While we briefly summarize these tests here, greater detail is provided in the web appendix, Section B.

One concern raised above is endogenous program targeting, or that health facilities in low usage areas may increase their FP outreach, training, etc. in an effort to improve usage. To address this concern, we include district-level fixed effects in our model. We test for program targeting by (1) estimating our model with and without these fixed effects, (2) calculating the joint covariance matrix (see Mroz (1987) for details) of the two sets of estimated coefficients, and (3) conducting a Wald test for significantly different effects of the independent variables. We find a small, statistically significant difference in the estimates, suggesting strategic program targeting; therefore, justifying our inclusion of fixed effects.

A second concern is the identification of the model parameters. While the model is identified by it’s non-linearity, we utilized exclusion restrictions to improve the efficiency of the estimator. We conducted a series of tests to show that (1) these variables have a jointly significant effect on the up to God and ideal number of children variables, (2) these variables have no direct effect on the FP decision, and (3) model parameters are quite stable when we rely solely on the non-linearity of the model for identification, which is consistent with Mroz’s (1999) Monte Carlo study on identification using discrete factor models.

A final concern is whether the up to God and ideal number of children variables are endogenous. We estimate the model both with and without correlation between the model’s unobservables. These two models reveal statistically significant and important differences in the point estimates of the ideal number of children equation, suggesting endogenous selection into a numeric response. The two models also reveal differences for the FP equation; however, because the two models make different assumptions about the error variance, we cannot statistically compare point estimates from the two estimation procedures. Therefore, we use simulations to test for differences between the models. These simulations provide clear evidence that the response to the ideal number of children question is endogenous to the FP decision.

5.3 Simulations

Simulations are done using a parametric bootstrap method that takes advantage of the fact that, under general conditions, maximum likelihood estimators for the coefficients are asymptotically normally distributed. Thus, all simulations use the estimated covariance matrix to sample from a multivariate normal distribution centered at the point estimates of the coefficients. The marginal effects and standard errors are calculated using 1000 bootstrap replications.

Our simulations are motivated by policy efforts to reduce family sizes in Senegal and in other sub-Saharan and West African countries, by improving the quality of health facilities. We use the preferred model to predict the change in contraceptive use (and other endogenous variables) when variables that measure quality, or proxy for quality, are altered. For example, the first row of Table 8 shows the effect of ensuring that all women have at least one health social worker within one-kilometer of their home. This change decreases the probability that the woman responds “up to God” by 6.0 percentage points and, conditional on answering the question, decreases the average ideal number of children by 0.169.

Furthermore, the combined direct effect of the additional health social worker, along with the effect of the altered endogenous variables, is a 1.9 percentage point increase in the likelihood of using a FP method. All of these effects are statistically different from zero at a 1% level of significance.

Our simulations suggest that, among the policy variables we study, instituting family planning protocols and increasing the number of pharmacists are the most effective methods for increasing contraceptive use. Increasing the proportion of facilities with a FP protocol from 50% to 100% increases contraceptive use by 2.1 percentage points. Moreover, shifting the proportion of pharmacies with multiple pharmacists from 0% to 50% would increase FP method use by 6.0 percentage points.[9] To our knowledge, this is the first paper to quantify the important role that pharmacists play in promoting FP practices. The effects of increasing education levels and directly reducing ideal family size are also reported in Table 8.

[Table 8]

6. Conclusion

We have three main findings. First, unlike women in rural areas, access to health facilities and contraceptive methods is not lacking for Senegalese women living in urban environments. Therefore, we do not find that increasing the number of health facilities, number of pharmacies, or average number of contraceptive methods offered at facilities and pharmacies would increase FP use. However, we do find that the quality of facilities and pharmacies affect FP practices. Second, we find that a woman's response to the ideal number of children question both affects and is endogenous to her usage of contraceptives. Failure

[9] Currently, 85% of health facilities have a family planning protocol and 22% of the pharmacies have multiple pharmacists.

to control for this endogeneity leads to bias in estimated marginal effects. Third, understanding the preferences of women reporting that they wish to leave their total number of children "up to God" is important for programs and policies aimed at reducing family size and increasing FP use. In our data, these women are among the least likely to use FP and have (on average) 0.87 more children than the women providing a numerical response. Given these results, we would advise against the popular practice of dropping "up to God" responders.

In 2010, the Senegalese government committed to increasing the modern contraceptive prevalence rate among married women nationally from 12% to 27% by 2015; this goal was not reached. Our findings suggest that in developing strategies for the next program cycle, program managers and policy makers should consider: (1) strengthening education programs given the strong spill-over effects found from women's level of education; (2) supporting health facilities to hire health social workers and create FP protocols; and (3) encouraging pharmacies to employ more actual pharmacists, rather than untrained staff.

References:

Agence Nationale de la Statistique et de la Démographie (ANSD) [Sénégal], et ICF International. 2012. Enquête Démographique et de Santé à Indicateurs Multiples au Sénégal (EDS-MICS) 2010-2011. Calverton, Maryland, USA: ANSD et ICF International.

Ainsworth, Martha, Kathleen Beegle, and Andrew Nyamete. "The impact of women's schooling on fertility and contraceptive use: A study of fourteen sub-Saharan African countries." *The World Bank Economic Review* 10, no. 1 (1996): 85-122.

Ali, Mohamed. M., "Quality of care and contraceptive pill discontinuation in rural Egypt." *Journal of Biosocial Science* 33 no 2 (2001): p. 161-72.

Ali Mohamed M, Cleland John, Shah Iqbal H. "Causes and consequences of contraceptive discontinuation: Evidence from 60 Demographic and Health Surveys." 2012. Geneva: WHO.

Angeles, Gustavo, David K. Guilkey, and Thomas A. Mroz. "Purposive program placement and the estimation of family planning program effects in Tanzania." *Journal of the American Statistical Association* 93, no. 443 (1998): 884-899.

Angeles, Gustavo, David K. Guilkey, and Thomas A. Mroz. "The determinants of fertility in rural Peru: Program effects in the early years of the national family planning program." *Journal of Population Economics*. 18 (2005): 367-389.

Angrist, J. D. and Jörn-Steffen Pischke (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*.

Arends-Kuenning, Mary, and Flora L. Kessy. "The impact of demand factors, quality of care and access to facilities on contraceptive use in Tanzania." *Journal of Biosocial Science* 39, no. 1 (2007): 1.

Canning, David, and T. Paul Schultz. "The economic consequences of reproductive health and family planning." *The Lancet* 380, no. 9837 (2012): 165-171.

Castle, Sarah. "Factors influencing young Malians' reluctance to use hormonal contraceptives." *Studies in Family Planning* 34, no.3 (2003): 186-199.

Chen, Susan, and David K. Guilkey. "Determinants of contraceptive method choice in rural Tanzania between 1991 and 1999." *Studies in Family Planning* 34, no. 4 (2003): 263-276.

Cleland, John, Agustin Conde-Agudelo, Herbert Peterson, John Ross, and Amy Tsui. "Contraception and health." *The Lancet* 380, no. 9837 (2012): 149-156.

Cleland, John G., Robert P. Ndugwa, and Eliya M. Zulu. "Family planning in sub-Saharan Africa: progress or stagnation?" *Bulletin of the World Health Organization* 89, no. 2 (2011): 137-143.

Cohen, Barney. "Family planning programs, socioeconomic characteristics and contraceptive use in Malawi." *World Development* 28, no. 5 (2000): 843-860.

Elfstrom, K. Miriam, and Rob Stephenson. "The Role of Place in Shaping Contraceptive Use among Women in Africa." *PloS one* 7, no. 7 (2012): e40670.

Ezeh, Alex C., John Bongaarts, and Blessing Mberu. "Global population trends and policy options." *The Lancet* 380, no. 9837 (2012): 142-148.

Ezeh, Alex C., Ivy Kodzi, and Jacques Emina. "Reaching the urban poor with family planning services." *Studies in Family Planning* 41, no. 2 (2010): 109-116.

Feyisetan, Bamikale J., and Martha Ainsworth. "Contraceptive use and the quality, price, and availability of family planning in Nigeria." *The World Bank Economic Review* 10, no. 1 (1996): 159-187.

Gertler, Paul J., and John W. Molyneaux. "How economic development and family planning programs combined to reduce Indonesian fertility." *Demography* 31, no. 1 (1994): 33-63.

Guilkey, David K., and Susan Jayne. "Fertility transition in Zimbabwe: Determinants of contraceptive use and method choice." *Population Studies* 51, no. 2 (1997): 173-189.

Guilkey, David K., and Peter Lance. "Program Impact Estimation with Binary Outcome Variables: Monte Carlo Results for Alternative Estimators and Empirical Examples" <u>Festschrift in Honor of Peter Schmidt</u> (Sickles and Horrace, ed.s) Springer: New York: 5-46, 2013.

Gwatkin DR, Rutstein S, Johnson K, et al. Socio-economic differences in health, nutrition, and population (HNP). Washington, DC: HNP/Poverty Thematic Group, World Bank; 2000.

Hong Rathavuth, Montana Livia, and Mishra Vinod, "Family planning services quality as a determinant of use of IUD in Egypt." *BMC Health Services Research*. 6 (2006): p. 79.

Khan, Shane, Vinod Mishra, Fred Arnold, and Noureddine Abderrahim. 2007. *Contraceptive Trends in Developing Countries.* DHS Comparative Reports No. 16. Calverton, Maryland, USA: Macro International Inc.

Magadi, Monica A., and Siân L. Curtis. "Trends and determinants of contraceptive method choice in Kenya." *Studies in Family Planning* 34, no. 3 (2003): 149-159.

Magnani Robert J, Hotchkiss David R, Florence Curtis S, Shafer Leigh A. "The impact of the family planning supply environment on contraceptive intentions and use in Morocco." *Studies in Family Planning* 30, no. 2 (1999): p. 120-32.

Measurement, Learning & Evaluation (MLE) Project and Initiative Sénégalese de Santé Urbaine (ISSU). 2011 Baseline Survey for the Senegal Urban Health Initiative (ISSU) Household Survey: Final Report. Chapel Hill, NC: IntraHealth. 2012a.

Measurement, Learning & Evaluation (MLE) Project and Initiative Sénégalese de Santé Urbaine (ISSU). 2011 Baseline Survey for the Senegal Urban Health Initiative (ISSU) Service Delivery Site Survey:: Final Report. Chapel Hill, NC: IntraHealth. 2012b.

Mensch, Barbara, Arends-Kuenning, Mary, Jain, Anrudh. "The impact of quality of family planning services on contraceptive use in Peru." *Studies in Family Planning 27, no. 2 (1996): 59-75.*

Montgomery, Mark R, Hewett, Paul C. Urban poverty and health in developing countries: Household and neighborhood effects. *Demography*, Vol 42 no. 3 (2005): 397-425.

Mroz, Thomas A. "The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions." *Econometrica* 55.4 (1987): 765-799.

Mroz, Thomas A. "Discrete factor approximations in simultaneous equation models: Estimating the impact of a dummy endogenous variable on a continuous outcome." *Journal of Econometrics* 92, no. 2 (1999): 233-274.

Mroz, Thomas A., Kenneth A. Bollen, Ilene S. Speizer, and Dominic J. Mancini. "Quality, accessibility, and contraceptive use in rural Tanzania." *Demography* 36, no. 1 (1999): 23-40.

Olaleye David O. "Ideal family size: a comparative study of numerical and non-numerical fertility desires of women in two sub-Saharan African countries." DHS Workign Papers. 1993. Number 7. Calverton: Macro International Inc.

Onwuzurike BK, Uzochukwu BSC. "Knowledge, attitude and practice of family planning amongst women in a high density low income urban of Enugu, Nigeria. " *African Journal of Reproductive Health* Vol. 5, No. 2, (2001), pp. 83-89

Ortayli, Nuriye, and Shawn Malarcher. "Equity analysis: Identifying who benefits from family planning programs." *Studies in Family Planning* 41, no. 2 (2010): 101-108.

Pitt, Mark M., Mark R. Rosenzweig, and Donna M. Gibbons. "The determinants and consequences of the placement of government programs in Indonesia." *The World Bank Economic Review* 7, no. 3 (1993): 319-348.

Riley, Ann P., Albert I. Hermalin, and Luis Rosero-Bixby. "A new look at the determinants of nonnumeric response to desired family size: the case of Costa Rica." *Demography* 30, no. 2 (1993): 159-174.

Rosenzweig, Mark R., and Kenneth I. Wolpin. "Evaluating the effects of optimally distributed public programs: Child health and family planning interventions." *American Economic Review* 76, no. 3 (1986): 470-82.

Saila-Ngita, Diafuka, Boris E. Bravo-Ureta, and Rafael Pérez-Escamilla. "Fertility desires and sample selection bias: The case of Senegal." *Journal of Asian and African Studies* 38, no. 1 (2003): 1-16.

Steele, F., S.L. Curtis, and M. Choe, "The impact of family planning service provision on contraceptive-use dynamics in Morocco." *Studies in Family Planning* 30 no. 1 (1999): p. 28-42.

Stephenson, Rob, Doris Bartel, and Marcie Rubardt. "Constructs of power and equity and their association with contraceptive use among men and women in rural Ethiopia and Kenya." *Global Public Health* 7, no. 6 (2012): 618-634.

Strauss, J. and D. Thomas (1995) "Human Resources: Empirical Modeling of Household and Family Decisions" Handbook of Development Economics Vol IIIA, eds Behrman and T. Srinivasan, Elsevier Science B. V. pp 1885-2023.

Tsui, Amy O., Raegan McDonald-Mosley, and Anne E. Burke. "Family planning and the burden of unintended pregnancies." Epidemiologic reviews 32, no. 1 (2010): 152-174.

UN-HABITAT. "Guide to monitoring target 11: Improving the lives of 100 million slum dwellers." Nairobi: UN-HABITAT. 2003

Upadhyay, Ushma D., and Deborah Karasek. "Women's Empowerment and Ideal Family Size: An Examination of DHS Empowerment Measures In Sub-Saharan Africa." *International Perspectives on Sexual and Reproductive Health* (2012): 78-89.

Wang, Wenjuan, Wang, Shanxiao, Pullum, Thomas, Ametepi, Paul. How family planning supply and the service environment affect contraceptive use: findings from four East African countries. DHS Analytical Studies No. 26. ICF International, Calverton, Maryland, USA. (2012).

Zulu, Eliya M, F. Nii-Amoo Dodoo, and Alex C Ezeh. "Sexual risk-taking in the slums of Nairobi, Kenya, 1993-98." *Population Studies*, 56 no. 3 (2002), 311-323.

Table 1: Summary of Dependent Variables

	Frequency	Percentage
Ideal Number of Kids		
0	8	0.1%
1	15	0.2%
2	349	3.6%
3	996	10.4%
4	2576	26.8%
5	1739	18.1%
6	1030	10.7%
7-8	550	5.7%
9-10	221	2.3%
11+*	51	0.5%
"Up to God"	1758	18.3%
Other non-numeric response	321	3.3%
Total	9614	100.0%
*Family Planning Method***		
None	7997	83.2%
Traditional	145	1.5%
Modern	1451	15.1%
No response	21	0.2%
Total	9614	100.0%

* The largest reported number of ideal kids is 20. In estimation, the range is capped at 15.

** There are 20 women that report using both modern and traditional methods; they are grouped with the former. Pregnant women (601) are not asked the family planning question; they are coded as using no family planning methods. Of the 181 women who cannot become pregnant, 11 do not answer the family planning question; they are coded as using no family planning methods.

Table 2: Summary of Family Planning Access and Quality Variables

	PSU level		Individual level	
	Mean	S.D.	Mean	S.D.
Health Facility Variables				
Number of public facilities	3.16	2.16	2.93	2.13
Number of private facilities	0.97	1.23	0.86	1.14
Number of high volume facilities	1.34	1.50	1.27	1.46
Number with (infant) delivery services	1.90	1.52	1.83	1.48
Average number of doctors in facility	0.81	1.38	0.74	1.29
Average number of nurses in facility	2.60	3.31	2.38	3.12
Average number of midwives in facility	2.16	2.14	2.01	1.98
Average number of FP methods sold	4.45	1.72	4.36	1.80
Average number IEC FP tools	2.15	1.13	2.08	1.13
% with family planning protocol	0.86		0.85	
% providing FP info during non-FP visit	0.74		0.75	
Any fac. has social program	0.16		0.15	
Any fac. has a health social worker	0.43		0.39	
Any fac. has an IEC outreach program	0.80		0.77	
Any fac. hosts health talks for the comm.	0.87		0.86	
Pharmacy Variables				
Number of pharmacies	10.17	6.71	9.27	6.21
Average number of methods sold	4.40	0.92	4.42	0.93
% with multiple pharmacists	0.22		0.19	
% requiring trained FP consultant	0.45		0.48	
% where staff can advise on FP	0.75		0.73	
Any pharm. has social program	0.15		0.15	
No health facility or pharmacy information	0.02		0.02	
Observations	263		9272	

Table 3: Summary of Individual level Independent Variables

	Mean	S.D.
Age	27.80	9.06
Education		
None	0.35	
Primary school	0.34	
Middle school	0.19	
High school or higher	0.12	
Income	3.81	3.45
Muslim	0.95	
Ethnicity		
Wolof	0.41	
Poular	0.21	
Serer	0.19	
Other	0.19	
Worked in last week	0.36	
Listens to radio	0.74	
Reads newspaper/magazine	0.32	
Has personal cell phone	0.72	
Has internet access	0.13	
Number of beds in the home	4.65	2.72
Employs help in the home	0.22	
Running water in the home	0.34	
Toilet in the home	0.87	
Married*	0.55	
Partner: other wives	0.30	
Partner: age	34.16	18.97
Partner: education		
None	0.40	
Primary school	0.11	
Middle school	0.08	
High school or higher	0.14	
Educated, but unsure of grade	0.29	
Partner: works	0.90	
Observations**	9272	

* Mean and standard deviation for all variables below 'married' are calculated for married individuals only. In estimation, partner variables are coded as zero for unmarried women.

**The sample is reduced from 9614 to 9272 because sample inclusion requires that women provide a numeric or "up to God" response to the ideal children question (-321), answer the family planning usage question (-20), and report their marriage status (-1). Other observations with missing variable values are replaced with sample means. The number of missing observations by variable is as follows: number of beds in home (11), employ help in home (16), running water in home (3), other wives (55), partner works (57), worked last week (12), listens to radio (8), reads newspaper/magazine (9), has personal cell phone (16), and has internet access (20).

Figure 1: Percentage of women using family planning methods by location of home, Dakar region

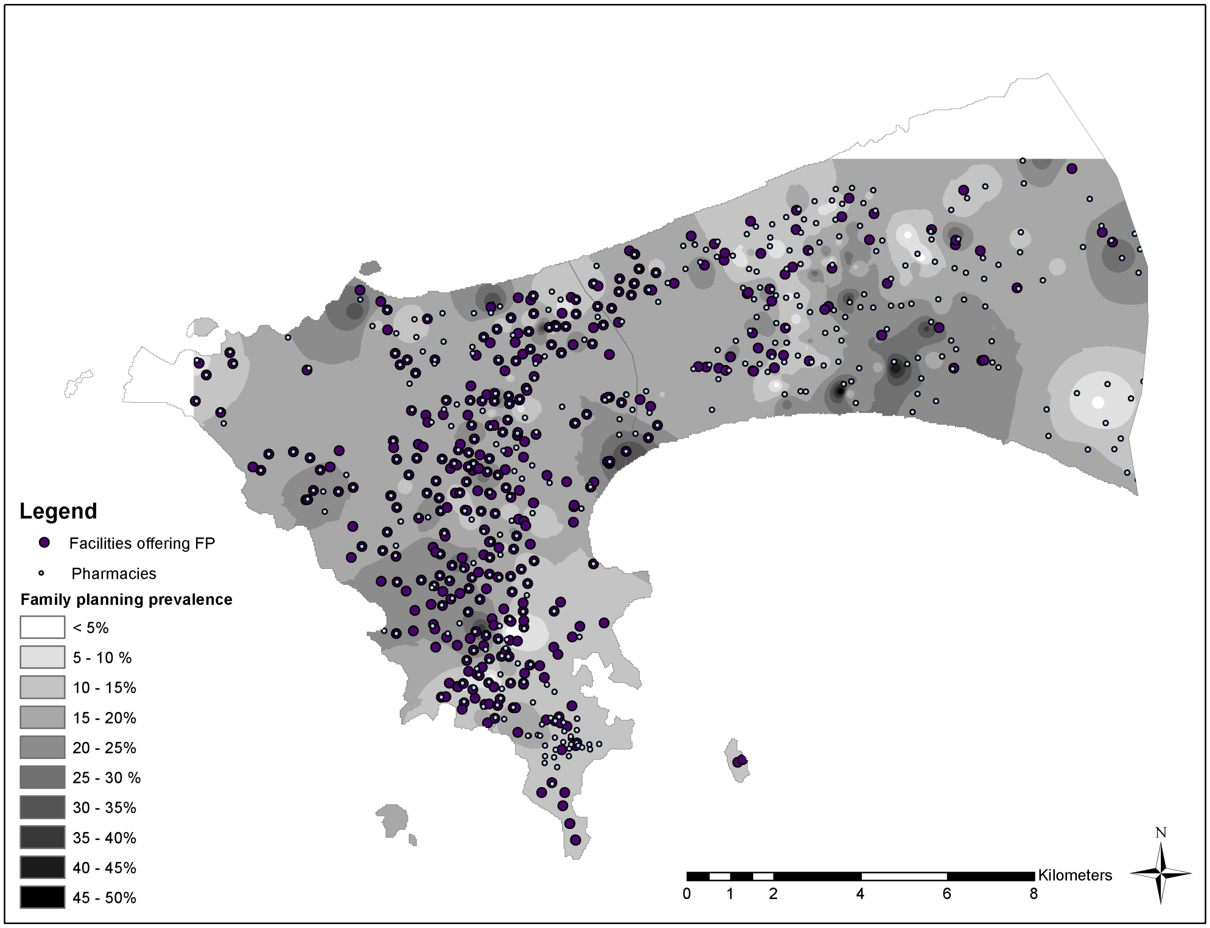

Table 4: Unobserved Heterogeneity Distribution

	Points of Support in Discrete Distribution			
	1 (Simple)	2	3	4
Number of Parameters	259	263	267	271
Likelihood Function Value	-21563.00	-20730.83	-20703.79	-20703.79
Likelihood Function Improvement		832.17	27.04	0.00
Probability Weights				
1	1.000	0.956	0.522	0.461
2		0.044	0.043	0.043
3			0.435	0.435
4				0.061

Table 5: Results for Any Use of Family Planning Methods

	Simple Model			Random Effects		
	Coef		SE	Coef		SE
Individual Variables						
Constant	-1.898	***	0.420	-13.224	***	2.000
Ideal number of kids	-0.178	**	0.070	-0.206	**	0.090
Number of kids is left "up to God"	-1.161	***	0.400	-1.616	***	0.579
Ideal number of kids * married	0.129	*	0.073	-0.129		0.117
Number of kids is left "up to God" * married	0.529		0.421	-1.611	*	0.868
Age (reference: 40+)						
15-19	-2.128	***	0.212	-2.976	***	0.358
20-24	-0.702	***	0.130	-1.272	***	0.257
25-29	-0.436	***	0.116	-0.795	***	0.224
30-34	-0.051		0.106	-0.143		0.212
35-39	0.046		0.106	0.105		0.212
Highest level of education (reference: none)						
Primary school	0.341	***	0.079	0.515	***	0.159
Middle school	0.612	***	0.120	1.030	***	0.233
High school or higher	0.428	***	0.144	0.444		0.282
Ethnicity (reference: other)						
Wolof	-0.074		0.091	-0.281		0.193
Poular	-0.032		0.101	-0.268		0.210
Serer	-0.140		0.103	-0.359	*	0.208
Socioeconomic status (reference: 1st quintile)						
2nd quintile	0.078		0.105	0.032		0.190
3rd quintile	0.068		0.106	0.087		0.184
4th quintile	0.005		0.111	-0.091		0.190
5th quintile	-0.136		0.116	-0.371	*	0.205
Muslim	-0.326	**	0.153	-0.930	***	0.297
Worked last week	0.243	***	0.066	0.362	***	0.122
Listens to radio	0.004		0.073	0.011		0.129
Reads the newspaper/magazines	-0.075		0.091	-0.222		0.177
Has a cell phone	0.010		0.078	0.124		0.136
Has internet access	-0.130		0.129	-0.084		0.228
Married	1.660	***	0.404	4.000	***	0.819
Partner: other wives	-0.186	**	0.082	-0.204		0.178
Partner: age	-0.121	**	0.048	-0.160	*	0.091
Partner: age is not known	-0.802	***	0.229	-1.097	**	0.439
Partner: highest education (reference: none)						
Primary school	0.473	***	0.116	1.112	***	0.364
Middle school	0.151		0.135	0.398		0.358
High school or higher	0.279	**	0.117	0.658	**	0.267
Educated, but unsure of grade	0.253	***	0.088	0.481	***	0.180
Partner: works	0.061		0.119	0.178		0.246
Health Facility and Pharmacy Variables						
Number of public facilities	0.014		0.040	-0.007		0.083
Number of private facilities	-0.015		0.061	-0.066		0.107
Number of high volume facilities	-0.008		0.063	0.033		0.115
Number of pharmacies	-0.008		0.015	-0.028		0.027

No facilities/pharmacies participate in survey	-0.224		0.313	-0.338		0.543
Average number of doctors at facility	-0.097		0.121	-0.136		0.217
Average number of nurses at facility	0.023		0.040	0.087		0.076
Average number of midwives at facility	0.006		0.071	-0.081		0.125
Prob. pharmacy has mult. pharmacisits	0.903	**	0.439	2.019	***	0.763
Prob. facility has a family planning protocol	0.285		0.257	0.768	*	0.453
Prob. pharmacy requires FP training	-0.213		0.251	-0.516		0.460
Prob. pharmacy allows staff to advise on FP	-0.174		0.245	-0.840	*	0.475
Average FP methods sold at health facility	-0.010		0.053	-0.032		0.094
Average FP methods sold at pharmacy	0.058		0.069	0.185		0.132
Any facility has an FP social program	-0.050		0.132	0.232		0.259
Any pharmacy has a FP social program	0.115		0.163	0.369		0.291
Any facility has a health social worker	0.183		0.147	0.171		0.264
Any facility has IEC outreach program	-0.127		0.128	-0.191		0.236
Any facility hosts health talks for the comm.	-0.100		0.202	-0.506		0.371
Prob. FP advice given during non-FP visit	-0.039		0.296	0.371		0.521
Average number if IEC FP materials at facility	0.039		0.062	0.020		0.117
DFRE Variables						
Point 1 (Normalized to Zero)				0.000		0.000
Point 2				12.409	***	2.047
Point 3				13.059	***	1.97
District Fixed Effects		Yes			Yes	
Observations		9272			9272	

* statistically significant at the 10% level.
** statistically significant at the 5% level.
*** statistically significant at the 1% level.

Table 6: Results for Ideal Number of Kids

	Simple Model			Random Effects		
	Coef		SE	Coef		SE
Individual Variables						
Constant	4.712	***	0.157	4.144	***	0.136
Age (reference: 40+)						
15-19	-0.041		0.096	0.138	*	0.077
20-24	-0.013		0.092	0.180	**	0.074
25-29	-0.031		0.090	0.152	**	0.072
30-34	-0.108		0.087	0.063		0.072
35-39	-0.072		0.090	0.066		0.074
Highest level of education (reference: none)						
Primary school	-0.476	***	0.053	-0.319	***	0.044
Middle school	-0.670	***	0.067	-0.430	***	0.057
High school or higher	-0.749	***	0.079	-0.523	***	0.065
Ethnicity (reference: other)						
Wolof	0.030		0.055	0.028		0.046
Poular	-0.097	*	0.059	-0.077		0.051
Serer	0.103	*	0.060	0.038		0.049
Socioeconomic status (reference: 1st quintile)						
2nd quintile	-0.106		0.068	-0.047		0.055
3rd quintile	-0.131	*	0.069	-0.087		0.055
4th quintile	-0.210	***	0.073	-0.133	**	0.059
5th quintile	-0.201	**	0.082	-0.133	**	0.067
Muslim	0.461	***	0.069	0.354	***	0.061
Worked last week	0.042		0.043	0.029		0.035
Listens to radio	-0.025		0.047	0.049		0.038
Reads the newspaper/magazines	-0.110	**	0.048	-0.104	**	0.042
Has a cell phone	0.021		0.047	0.028		0.039
Has internet access	-0.120	**	0.055	-0.163	***	0.046
Married	0.289		0.207	0.201		0.167
Partner has other wives	-0.057		0.068	-0.097	*	0.056
Partner: other wives	0.054		0.041	0.060	*	0.033
Partner: age	0.167		0.182	0.266	*	0.146
Partner: age is not known						
Partner: highest education (reference: none)	-0.086		0.096	-0.093		0.076
Primary school	-0.167	*	0.093	-0.065		0.079
Middle school	-0.133		0.086	-0.119		0.073
High school or higher	-0.260	***	0.072	-0.221	***	0.059
Educated, but unsure of grade	-0.056		0.103	-0.036		0.084
Number of beds in the home	0.041	***	0.009	0.031	***	0.007
Employs help in the home	-0.065		0.053	-0.052		0.043
Running water in the home	0.025		0.041	0.050		0.035
Toilet in the home	-0.145	**	0.063	-0.145	***	0.051
Health Facility and Pharmacy Variables						
Any facility has a health social worker	-0.186	***	0.072	-0.164	***	0.058
Any facility has comm. outreach program	0.099		0.063	0.054		0.052
Any facility conducts comm. Talks on FP	-0.087		0.106	-0.046		0.085
Prob. FP advice given during non-FP visit	0.090		0.149	0.154		0.115
Average number if IEC FP materials at facility	-0.026		0.025	-0.036	*	0.020
Number of health facilities with delivery services	0.034		0.025	0.029		0.019
DFRE Variables						
Point 1 (Normalized to Zero)				0.000		0.000
Point 2				4.809	***	0.126
Point 3				0.079		0.076

District Fixed Effects	Yes	Yes
Observations	7519	7519

* statistically significant at the 10% level. ** statistically significant at the 5% level. *** statistically significant at the 1% level.

Table 7: Results for Up to God

	Simple Model			Random Effects		
	Coef		SE	Coef		SE
Individual Variables						
Constant	-1.961	***	0.272	-2.149	***	0.358
Age (reference: 40+)						
15-19	-0.451	***	0.123	-0.516	***	0.127
20-24	-0.496	***	0.114	-0.560	***	0.118
25-29	-0.258	**	0.107	-0.314	***	0.110
30-34	-0.579	***	0.107	-0.640	***	0.112
35-39	-0.453	***	0.108	-0.515	***	0.112
Highest level of education (reference: none)						
Primary school	-0.356	***	0.068	-0.399	***	0.072
Middle school	-0.628	***	0.115	-0.698	***	0.121
High school or higher	-0.649	***	0.156	-0.707	***	0.162
Ethnicity (reference: other)						
Wolof	0.136		0.087	0.142		0.089
Poular	0.135		0.096	0.136		0.099
Serer	-0.021		0.101	-0.001		0.103
Socioeconomic status (reference: 1st quintile)						
2nd quintile	0.099		0.091	0.077		0.094
3rd quintile	0.036		0.096	0.022		0.099
4th quintile	-0.109		0.108	-0.139		0.112
5th quintile	-0.062		0.128	-0.076		0.132
Muslim	0.611	***	0.191	0.628	***	0.195
Worked last week	-0.018		0.062	-0.018		0.064
Listens to radio	-0.401	***	0.062	-0.416	***	0.064
Reads the newspaper/magazines	-0.281	***	0.095	-0.296	***	0.096
Has a cell phone	0.108	*	0.065	0.111	*	0.068
Has internet access	-0.721	***	0.143	-0.718	***	0.145
Married	-0.473	*	0.251	-0.497	*	0.262
Partner: other wives	0.142	*	0.081	0.172	**	0.086
Partner: age	0.142	***	0.046	0.148	***	0.048
Partner: age is not known	0.913	***	0.216	0.919	***	0.226
Partner: highest education (reference: none)						
Primary school	-0.268	**	0.132	-0.275	**	0.136
Middle school	-0.869	***	0.180	-0.901	***	0.185
High school or higher	-0.145		0.129	-0.160		0.134
Educated, but unsure of grade	-0.121		0.085	-0.130		0.088
Partner: works	0.207	*	0.119	0.224	*	0.125
Number of beds in the home	0.018		0.013	0.022	*	0.013
Employs help in the home	-0.147		0.091	-0.154	*	0.093
Running water in the home	-0.007		0.067	-0.013		0.069
Toilet in the home	0.369	***	0.102	0.366	***	0.105
Health Facility and Pharmacy Variables						
Any facility has a health social worker	-0.457	***	0.111	-0.475	***	0.116
Any facility has comm. outreach program	0.086		0.092	0.108		0.095
Any facility conducts comm. Talks on FP	-0.185		0.138	-0.188		0.114
Prob. FP advice given during non-FP visit	0.880	***	0.205	0.881	***	0.212
Average number if IEC FP materials at facility	-0.109	***	0.038	-0.114	***	0.039
Number of health facilities with delivery services	0.143	***	0.035	0.143	***	0.036
DFRE Variables						
Point 1 (Normalized to Zero)				0.000		0.000
Point 2				-11.482	***	0.367

Point 3			0.636	0.484
District Fixed Effects	Yes		Yes	
Observations	9272		9272	

* statistically significant at the 10% level. ** statistically significant at the 5% level. *** statistically significant at the 1% level

Table 8: Simulated Changes in Endogenous Variables

	Up to God			Ideal Kids			Family Planning Use		
Change in Independent Variable	Change		SE	Change		SE	Change		SE
Any health social worker: 0 to 1	-0.060	***	0.0004	-0.169	***	0.0018	0.019	***	0.0004
Health facilities have family planning protocol: 0% to 50%	*		*	*		*	0.020	***	0.0004
Health facilities have family planning protocol: 50% to 100%	*		*	*		*	0.021	***	0.0004
Pharmacies have multiple pharmacists: 0% to 50%	*		*	*		*	0.060	***	0.0007
Pharmacies have multiple pharmacists: 50% to 100%	*		*	*		*	0.064	***	0.0007
Education: none to primary	-0.054	***	0.0003	-0.331	***	0.0014	0.039	***	0.0003
Education: primary to middle	-0.036	***	0.0004	-0.118	***	0.0014	0.038	***	0.0004
Education: middle to high	-0.001		0.0005	-0.093	***	0.0016	-0.035	***	0.0004
Ideal kids: 5 to 3	*		*	*		*	0.038	***	0.0004

Note: For up to God and family planning use, the table reports the predicted *percentage point* change in the likelihood of a positive response. For ideal number of kids, the table reports the predicted change in the number of kids.
* statistically significant at the 10% level.
** statistically significant at the 5% level.
*** statistically significant at the 1% level.